REMARKS

Claims 1-7, 35-37, and 65-67 were pending in the application. By this paper, claims 66 and 67 have been canceled herein without prejudice and claims 1, 4, and 65 have been amended. Thus, claims 1-7, 35-37, and 65 remain pending. Reconsideration and withdrawal of the rejections are hereby respectfully solicited in view of the foregoing amendments and the remarks.

Claim Rejections - 35 U.S.C. §102

Claims 1-7, 35-37, 65, and 66 were rejected under 35 U.S.C. §102(b) as anticipated by Rezanka, U.S. Patent No. 5,818,485 (Rezanka). Claim 1 has been amended to recite a piezoelectric actuator and, from canceled claim 67, that the flow through each chamber is at least ten times greater than the maximum fluid flow of droplets ejected through the orifice of the chamber. Claim 4 has been amended to recite a piezoelectric actuator associated with each chamber for droplet ejection. Claim 65 has been amended to recite the step of effecting droplet ejection from a selected chamber by actuating a piezoelectric actuator associated with that chamber and, like claim 1, has also been amended to recite that the flow in each in chamber is at least ten times greater than the maximum fluid flow of droplets deposited through the orifice. The amendments are believed to place the claims in condition for allowance.

Rezanka discloses a *thermal* inkjet printing system. As is well known, such systems operate through the use of a *resistance heater which vaporizes ink to form a bubble*, which leads in turn to ejection of a droplet of ink from a nozzle. Rezanka states for example at col. 1, lines 7-8, that it pertains to an "ink circulation system for a thermal ink jet printer." In contrast, the present invention relates to an alternative form of inkjet printing in which droplet ejection is effected through *piezoelectric actuators*. All claims of the instant application, as amended, specifically recite piezoelectric actuation or the inclusion of a piezoelectric actuator.

Rezanka is exclusively directed to the thermal technique of ink delivery as noted above. Such a printer does not use or include a piezoelectric actuator and, as a result, fails to teach employing a piezoelectric actuator to effect ink ejection. Rezanka does not anticipate

amended claims 1, 4, and 65, nor their respective dependent claims 2, 3, 5-7, and 35-37. The anticipation rejection under §102(b) should be withdrawn for at least this reason.

Though not rejected under §103(a) over Rezanka, claims 1-7, 35-37, and 65 are not rendered obvious by the teachings of Rezanka when taken alone. First, a *prima facie* case of obviousness necessarily requires that the prior art teach or suggest all of the claim limitations. Rezanka fails to disclose or suggest the limitations of either employing a piezoelectric actuator for effecting droplet ejection or including the step of effecting droplet ejection via a piezoelectric actuator. Rezanka fails to teach or suggest every limitation of amended claims 1, 4, and 65.

Second, Rezanka does not teach or suggest to one of ordinary skill in the art that its *thermal ink jet system* teachings could be applied to a piezoelectric actuation printer system claimed by the applicants. Thus, there is simply no motivation or suggestion found within Rezanka that would lead one of ordinary skill in the art to modify and apply its teachings to a piezoelectric actuation device. The operational parameters, problems, ink characteristics, and the like are different for the two types of systems. One looking to improve upon a piezoelectric ink jet system would not be motivated to look to the teachings of a thermal ink jet system for suggestions to do so, and the official action has not pointed to any motivation or suggestion within Rezanka for actually doing so.

Third, referring to thermal ink jet printing systems, Rezanka states for example, at col. 1, lines 43-45, that

> one problem with this type of ink delivery system is that inks can stagnate in the channel during non-printing intervals. An undesirable consequence of the stagnation is that some water in ink evaporates causing the ink to thicken and gradually adversely effect the droplet ejection. If the printhead remains inactive for a sufficiently long period, ink can eventually completely dry out.

The problem addressed by the applicants is <u>not</u> to prevent water based inks from stagnating and drying out. Instead, the problem addressed by the applicants is to ensure reliable high quality printing by preventing (or reducing to a minimum) the occurrence of blockage of an orifice by a foreign body in the ink. The present invention achieves this objective by establishing a continuous and high flow rate through the chamber. The chamber flow rate is so much greater (ten times greater in claims 1 and 65) than the flow rate of droplets ejected through the orifice that any foreign body is swept with the main ink flow past

the orifice and right on through the chamber. The foreign body is simply not allowed to enter and possibly block the orifice.

One having ordinary skill in the art, taking note of Rezanka, will recognize (after also noting the applicants' invention) that a flow rate necessary to avoid stagnation and drying out of ink, regardless of whether considering a thermal system or a piezoelectric system, is very much lower than any flow rate necessary to ensure that a foreign body does not enter the droplet ejection orifice, as recited in claim 4. Such a skilled person would more particularly recognize that the flow rate necessary to avoid stagnation and drying out of ink is very much smaller than ten times the flow rate through the orifice, as recited in claims 1 and 65. Accordingly, even if one having ordinary skill in the art were to look to the teachings of Rezanka (and as noted above there is no motivation for one of ordinary skill in the art piezoelectric droplet ejection systems or methods to look to the Rezanka disclosure), there is no teaching or suggestion that would lead to a construction or method falling within the scope of amended claims 1, 4, and 65.

Thus, for all of the above reasons, any rejection of claims 1-7, 35-37, and 65 as being obvious over Rezanka would be improper.

Additionally, though the claim rejection under 35 U.S.C. §102(b) is moot in view of the amendments presented herein, the applicants wish to point out that Rezanka also fails to disclose the following further dependent claim limitations:

- that the fluid flow through each chamber is sufficient to prevent foreign bodies in the fluid from lodging in the orifice.
- that the flow resistance of the inlet and outlet manifolds is chosen such that a negative static pressure of the orifice of any chamber in the array, due to flow variations between any two chambers, varies between the two chambers in the array by the amount less than would give rise to significant differences in droplet ejection properties.
- that fluid flow into each chamber is sufficiently greater than the maximum fluid flow of droplets deposited through the orifice such that any foreign body in the fluid in the chamber that would otherwise inhibit droplet ejection, if the foreign body entered the orifice, is by virtue of the flow through the chamber more likely to flow past the orifice than into it.

- that the fluid flow resistance in the inlet and outlet manifolds is sufficiently small such that the position of the meniscus when droplet ejection is being effected does not differ across the array.
- that the flow into each chamber is sufficiently greater than the maximum fluid flow of droplets deposited through the orifice of the chamber such that the fluid flow rate through each chamber remains substantially constant.

For at least these additional reasons, the dependent claims are neither anticipated nor rendered obvious by Rezanka.

Claim Rejections - 35 U.S.C. §103

Claim 67 was rejected under 35 U.S.C. §103(a) as obvious over Rezanka. This rejection remains relevant in view of the fact that the subject matter of claim 67 has been incorporated into claims 1 and 65 discussed above. Thus, we address thus rejection in view of amended claims 1 and 65. In addition to all of the foregoing reasons, claims 1 and 65, and their corresponding dependent claims, are not rendered obvious by Rezanka for the following reasons as well.

With all due respect, this rejection is based on a misunderstanding of Rezanka. The official action states that

> [i]t should be clear from the disclosure of Rezanka however that the flow into each chamber is greater than the maximum fluid flow of droplets deposited through the orifice of the chamber. If this was not the case, the disclosed motivation [of] preventing ink thickening and drying could not properly occur (abstract).

This is simply incorrect. As noted above, one having ordinary skill in the art of thermal ink jet systems will easily recognize that prevention of ink thickening and drying can very easily be achieved with a flow through each chamber that is not much greater than the maximum flow of droplets deposited through the orifice of the ink chamber. *In fact, ink thickening and drying can be prevented with an ink flow through the chamber that is very much less than the maximum fluid flow of droplets deposited through the orifice of the chamber.* In other words, even a minimal flow of ink can accomplish the purpose of Rezanka. As explained in Rezanka at col. 1, lines 38-56, prevention of ink thickening and

drying caused by inactive or non-printing intervals can satisfactorily be achieved by the periodic movement of the inkjet printhead to a maintenance station for priming, i.e. flushing the stagnant or dry ink from the system. This is said to be wasteful of ink. Rezanka solves this problem with a continuous ink circulation system. Accordingly, one having ordinary skill in the art will understand from Rezanka that the problem to be solved, ink stagnation or drying, is a complete lack of flow in a chamber for a substantial period of time. A very small continuous flow through a chamber will accordingly be sufficient to overcome the problem of stagnation as set forth by Rezanka.

The official action goes well beyond these teachings of Rezanka to say that it would have been obvious to modify the teachings of Rezanka so that the flow into each chamber is ten times greater than the maximum fluid flow of droplets deposited through the orifice of the chamber. The official action asserts that the motivation for the skilled person to do so would be to gain the benefit of preventing ink thickening or drying out the ink at the nozzles. There is no such motivation for at least three reasons.

First, the gain or the benefit disclosed in Rezanka of preventing ink thickening or drying out in ink nozzles applies only to thermal ink delivery and to thermal ink delivery. Second, stagnation and drying are preventable at flow rates very much smaller than the maximum fluid flow of droplets deposited through the ejection orifice. As discussed above, the solution to the ink stagnation or drying problem is simply to move or circulate the ink. This can be done at fluid flow rates much less than ten times greater than, *and even at flow rates much less than*, the maximum fluid flow of droplets deposited through the ejection orifice.

Third, one of ordinary skill in the art would not be motivated by Rezanka to establish high flow rates through an array of ink jet chambers because high flow rates create other problems such as pressure losses and difficulty in ensuring precise pressure control across a set of ink ejection orifices. Without the teachings of the applicants' present invention, the fear of pressure variations across the array of orifices and variations in rest meniscus positions would create a prejudice against such high flow rates. This is particularly the case with piezoelectric actuation of the present application, where droplet ejection is typically effected through a pressure wave traveling along an ink jet chamber. Thus, Rezanka would actually teach away from the systems and methods as recited in claims 1 and 65.

For all of the above reasons, amended claims 1, 4, and 65 and their corresponding dependent claims are not rendered obvious by the teachings of Rezanka. These claims are believed to be in condition for allowance.

CONCLUSION

Claims 1-7, 35-37, and 65 are in condition for allowance in view of the foregoing amendments and remarks. Reconsideration and withdrawal of the rejections are hereby respectfully solicited.

The examiner is invited to contact the undersigned at the telephone number listed below in order to discuss any remaining issues or matters of form that will place this case in condition for allowance.

A petition for a two-month extension of time and the appropriate fee, and a RCE and appropriate fee, accompany this paper. No additional fee is believed due at this time. However, the Commissioner is hereby authorized to charge any fee deficiency, or to credit any overpayments, to Deposit Account No. 13-2855 of the undersigned's firm.

Respectfully submitted,

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